
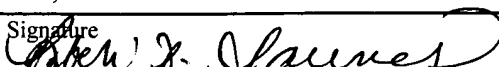




PATENT

| Attorney Docket No. | Serial No. |
|---------------------|------------|
| 100P270US01 | 10/781,397 |

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|--|---|-----------|--------------|
| In re Application of: | Daniel L. Franklin et al. | | |
| Serial No.: | 10/781,397 | Examiner: | Ing-Hour Lin |
| Confirmation No.: | 1881 | Art Unit: | 1725 |
| Filed: | February 18, 2004 | | |
| For: | METHOD OF DRYING A SAND MOLD USING A VACUUM | | |
| We are transmitting the following documents: | | | |
| Return Postcard | | | |
| Transmittal Letter [1 page] | | | |
| Fee Transmittal for FY 2005 [1 page] | | | |
| Appeal Brief [24 pages] | | | |

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|---|-----------------------------|--|
| Registration No. 45,070 | Direct Dial 612-331-7419 | Responsible Signatory  |
| Date: June 22, 2005 | | Robin A. Sannes |
| United States Patent and Trademark Office Customer No. 23322 | | |
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PTO/SB/17 (12-04)

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FEE TRANSMITTAL

For FY 2005

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT (\$) 500.00

Complete if Known

| | |
|----------------------|---------------------------|
| Application Number | 10/781,397 |
| Filing Date | February 18, 2004 |
| First Named Inventor | Daniel L. Franklin et al. |
| Examiner Name | Ing-Hour Lin |
| Art Unit | 1725 |
| Attorney Docket No. | 100P270US01 |

METHOD OF PAYMENT (check all that apply)☐ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____☒ Deposit Account Deposit Account Number: **50-0549** Deposit Account Name: **IPLM Group, P.A.**

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☒ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, except for the filing fee☒ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☒ Credit any overpayments**WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.****FEE CALCULATION****1. BASIC FILING, SEARCH, AND EXAMINATION FEES**

| Application Type | FILING FEES | | SEARCH FEES | | EXAMINATION FEES | | Fees Paid (\$) |
|------------------|-------------|-----------------------|-------------|-----------------------|------------------|-----------------------|----------------|
| | Fee (\$) | Small Entity Fee (\$) | Fee (\$) | Small Entity Fee (\$) | Fee (\$) | Small Entity Fee (\$) | |
| Utility | 300 | 150 | 500 | 250 | 200 | 100 | |
| Design | 200 | 100 | 100 | 50 | 130 | 65 | |
| Plant | 200 | 100 | 300 | 150 | 160 | 80 | |
| Reissue | 300 | 150 | 500 | 250 | 600 | 300 | |
| Provisional | 200 | 100 | 0 | 0 | 0 | 0 | |

2. EXCESS CLAIM FEES

| Fee Description | Fee (\$) | Small Entity Fee (\$) |
|---|----------|-----------------------|
| Each claim over 20 or, for Reissues, each claim over 20 and more than in the original patent | 50 | 25 |
| Each independent claim over 3 or, for Reissues, each independent claim more than in the original patent | 200 | 100 |
| Multiple dependent claims | 360 | 180 |

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|---|---------------------|-----------------|----------------------|----------------------------------|-----------------|----------------------|
| Total Claims | Extra Claims | Fee (\$) | Fee Paid (\$) | Multiple Dependent Claims | Fee (\$) | Fee Paid (\$) |
| _____ - 20 or HP = _____ x _____ = _____ | | | | | | |
| HP = highest number of total claims paid for, if greater than 20 | | | | | | |
| Indep. Claims | Extra Claims | Fee (\$) | Fee Paid (\$) | | | |
| _____ - 3 or HP = _____ x _____ = _____ | | | | | | |
| HP = highest number of independent claims paid for, if greater than 3 | | | | | | |

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

| | | | | |
|---|---------------------|---|-----------------|----------------------|
| Total Sheets | Extra Sheets | Number of each additional 50 or fraction thereof | Fee (\$) | Fee Paid (\$) |
| _____ - 100 = _____ / 50 = _____ (round up to a whole number) x _____ = _____ | | | | |

4. OTHER FEE(S)

Non-English Specification, \$130 fee (no small entity discount)

Other: Appeal Brief

\$500.00

SUBMITTED BY

| | | | | | |
|-------------------|------------------------|-----------------------------------|---------------|-----------|--------------|
| Signature | <i>Robin A. Sannes</i> | Registration No. (Attorney/Agent) | 45,070 | Telephone | 612-331-7419 |
| Name (Print/Type) | Robin A. Sannes | Date | June 22, 2005 | | |

This collection of information is required by 37 CFR 1.136. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BOARD OF PATENT APPEALS AND INTERFERENCES

In re Application of: Daniel L. Franklin et al. Examiner: Ing-Hour Lin
Serial No.: 10/781,397 Group Art Unit: 1725
Confirmation No.: 1881 Docket No.: 100P270US01
Filed: February 18, 2004
Title: METHOD OF DRYING A SAND MOLD USING A VACUUM

APPEAL BRIEF

Mail Stop: Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is an appeal from the Final Rejection mailed April 20, 2005 rejecting claims 1-22.
The Notice of Appeal was filed via facsimile on May 13, 2005. Accordingly, the due date for
this Appeal Brief is July 13, 2005. The fee required under 37 CFR §41.20(b)(2) for the appeal
should be charged to Deposit Account No. 50-0549.

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Docket No. 100P270US01

REAL PARTY IN INTEREST

The real party in interest is Hormel Foods, LLC, the assignee of the patent application, as evidenced by the Assignment recorded on February 18, 2004 at Reel 014999, Frame 0462.

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RELATED APPEALS AND INTERFERENCES

Appellant, Appellant's legal representative, and the assignee are not aware of any appeals or interference proceedings before the U.S. Patent and Trademark Office that will directly affect, be directly affected by, or have a bearing on the Board's decision in this appeal.

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STATUS OF CLAIMS

Claims 1-22 were filed with the application on February 18, 2004. In an Office Action mailed October 27, 2004, claims 1-22 were rejected. An Amendment was filed on January 26, 2005 amending claims 7, 16, 17, 18, and 22. Claims 1-22 were rejected in a Final Office Action mailed April 20, 2005. Claim 1-22 are pending. This appeal followed, and claims 1-22 are the claims being appealed.

In re Application of Daniel L. Franklin et al.
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Docket No. 100P270US01

STATUS OF AMENDMENTS

No Amendments have been filed subsequent to the final rejection of claims 1-22.

The Appendix containing a listing of the claims involved in the appeal incorporate all of the amendments made by Appellant.

SUMMARY OF CLAIMED SUBJECT MATTER

A concise explanation of the invention for each of the independent claims involved in the appeal is as follows:

Claim 1

Claim 1 recites a method of making a sand mold. A sand mold mixture containing moisture is placed into a pattern, and the sand mold mixture is restrained in the pattern. The sand mold mixture is exposed to a vacuum, the vacuum being low enough to flash off the moisture in the sand mold mixture thereby drying the sand mold mixture to create a sand mold. The restrained sand mold mixture prevents voids in the sand mold.

As discussed on page 4, lines 23-26 of the specification, the vacuum lowers the absolute pressure within the sand mold mixture and reduces the boiling point of the moisture so the moisture flashes off to dry the sand mold relatively quickly. As discussed on page 6, lines 18-25, the sand mold mixture is restrained during the application of the vacuum to prevent voids from forming in the sand mold. If the sand mold mixture is not restrained during vacuum drying, voids will form in the sand mold, especially in relatively large sand molds.

Claim 8

Claim 8 recites a method of making a sand mold. A sand mold mixture containing moisture is placed into a pattern. A restraining member is placed onto the pattern. The

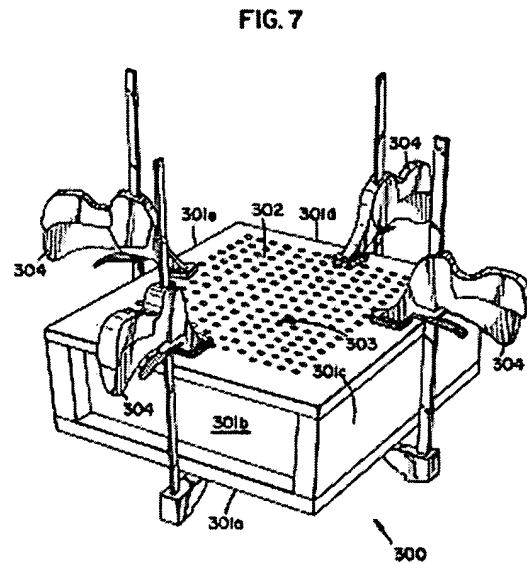
restraining member restrains the sand mold mixture within the pattern. The restrained sand mold mixture filled pattern is exposed to a vacuum. The vacuum is low enough to flash off the moisture in the sand mold mixture thereby drying the sand mold mixture to create a sand mold. The restraining member prevents voids in the sand mold.

As discussed on page 4, lines 23-26 of the specification, the vacuum lowers the absolute pressure within the sand mold mixture and reduces the boiling point of the moisture so the moisture flashes off to dry the sand mold relatively quickly. As discussed on page 6, lines 18-25, a restraining member is used to restrain the sand mold mixture during the application of the vacuum to prevent voids from forming in the sand mold. If the sand mold mixture is not restrained during vacuum drying, voids will form in the sand mold, especially in relatively large sand molds.

Claim 18

Claim 18 recites a method of making a sand mold. A sand mold mixture containing moisture is placed into a pattern. The sand mold mixture is restrained in the pattern by placing a perforated lid on the pattern. The perforated lid has apertures with a hydraulic radius of 0.5 inch or less. The pattern containing the sand mold mixture is exposed to a vacuum. The vacuum is low enough to flash off the moisture in the sand mold mixture thereby drying the sand mold mixture to create a sand mold. The restraining member prevents voids in the sand mold.

With regard to claim 18, an exemplary embodiment of the claimed subject matter is shown in Fig. 7:



Making a sand mold using the exemplary pattern 300 shown in Fig. 7 is discussed on page 4, line 13 through page 5, line 26 of the specification. In sum, a sand mold mixture containing moisture is placed into a pattern 300, and a perforated lid 302 is placed on the pattern 300 to restrain the sand mold mixture in the pattern 300. The perforated lid 302 has apertures 303 with a hydraulic radius of 0.5 inch or less. The sand mold mixture is restrained on all sides by the pattern 300 and the perforated lid 302. The pattern 300 containing the sand mold mixture and the perforated lid 302 are exposed to a vacuum, and the vacuum is low enough to flash off the moisture in the sand mold mixture thereby drying the sand mold mixture to create a sand

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mold. The perforated lid 302 prevents voids in the sand mold because the sand mold mixture is restrained on all sides by the pattern box 300 and the perforated lid 302.

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GROUND OF REJECTION TO BE REVIEWED ON APPEAL

Claims 1-22 stand rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 4,226,277 to Matalon in view of U.S. Patent 5,320,157 to Siak et al.

ARGUMENTS

Rejection under 35 U.S.C. 103(a) over U.S. Patent 4,226,277 to Matalon in view of U.S. Patent 5,320,157 to Siak et al.

Claims 1-22

Matalon discloses rapidly drying a silicate binder in a sand mold having preferably two or more air permeable sides (perforated faces) by forcing or drawing air through the permeable sides of the mold box and the sand contained therein by application of air pressure or vacuum. The movement of air through the mold box and the sand mold does not generate an internal pressure in the sand mold (lower the absolute pressure within the sand mold) to flash off the moisture in the sand mold as recited in the claimed subject matter. Rather, Matalon relies upon the movement of air through the sand mold to dry the binder in the sand mold. Matalon neither teaches nor suggests using a vacuum to flash off the moisture in the sand mold as recited in the claimed subject matter. Further, Matalon neither teaches nor suggests using a restraining member to prevent voids in the sand mold. The purpose of the air permeable sides is to provide ventilation as the air moves through the sand mold, as disclosed in column 7, lines 50-53 and in column 8, lines 9-11 and lines 48-49.

Although Siak et al. discloses the use of a vacuum to remove residual water from a sand core, nothing in Siak et al. either teaches or suggests using a restraining member to restrain the

sand during vacuum treatment. Further, Siak et al. does not disclose the problem of voids in the sand mold resulting from vacuum drying.

When a vacuum is applied, the sand may move and create cracks, voids, or other defects in the sand mold if the sand mold mixture is not restrained. The restrained sand mold mixture and the restraining member of the claimed subject matter help contain the sand and allow moisture to be flashed off of the sand quickly without disturbing the sand and creating voids in the sand mold. In addition, the restrained sand mold mixture maintains the pressure inside the sand mold mixture at a level such that the moisture that vaporizes at the maximum rate can pass through the sand without causing popping, cracking, or other defects of the sand mold. The permeable sides of Matalon allow the movement of air through the mold box for ventilation and, therefore, the permeable sides do not serve the same function of restraining the sand mold to prevent cracks, voids, or other defects in the sand mold. Matalon neither teaches nor suggests using the permeable sides to restrain the sand mold during vacuum treatment of the sand mold to prevent voids in the sand mold.

Because Matalon discloses the movement of air through a sand mold and Siak et al. discloses the use of a vacuum, there is no motivation to combine these references as they relate to different methods of drying a sand mold. One skilled in the art would not look to Matalon in determining how to use a vacuum to dry a sand mold, and one skilled in the art would not look to Siak et al. in determining how to move air through a sand mold to dry the sand mold. There

must be a basis in the art for combining the references, and because these references relate to different methods of drying a sand mold, there is no basis for combining these references.

Further, neither Matalon nor Siak et al. discloses the problem of voids in sand molds caused by vacuum drying. Therefore, using a restraining member to prevent voids in sand molds caused by vacuum drying is neither taught nor suggested by these references alone or in combination with one another. The claimed subject matter uses a vacuum to assist in rapidly drying restrained sand molds without producing cracks, voids, or other defects in the sand molds. This is neither taught nor suggested by these references.

The vacuum lowers the absolute pressure (reduces the boiling point of the moisture) within the sand mold mixture so the moisture flashes off the sand mold mixture thereby drying the sand mold mixture to create a sand mold. If the sand mold mixture is not restrained and a vacuum level sufficient to flash off the moisture is used, popping, cracking, or other defects of the sand mold result rendering the sand mold useless. In other words, the moisture in the sand mold mixture would boil too quickly and the sand mold would become deformed because some of the sand would be blown apart. As the vacuum level is lowered, the pressure within the sand mold is lowered and the temperature at which the moisture boils is also lowered. The lowest (strongest) vacuum level should be used to dry the sand mold more quickly. If just air is used without heat or vacuum, then it would be more difficult to dry the sand mold in this short period of time.

The sand mold mixture is restrained during the application of the vacuum to reduce the drying time while preventing cracks, voids, or other defects from forming in the sand mold. The restrained sand mold mixture allows moisture to be drawn out of the sand mold mixture quickly without disturbing the sand and forming voids in the resulting sand mold. In addition, the restrained sand mold mixture maintains the pressure inside the sand mold mixture at a level such that the moisture that vaporizes at the maximum rate can pass through the sand mold mixture without causing popping, cracking, or other defects of the sand mold. In other words, the pressure inside the sand mold mixture generated by the “boiling” water is significantly greater than the pressure surrounding the pattern. The pressure difference between the sand mold mixture inside of the pattern and the outside of the pattern surrounding the sand mold mixture is great enough that without the restraining member, the sand will “explode” out of the pattern thus ruining the sand mold. This is neither taught nor suggested by either Matalon or Siak et al.

Neither Matalon nor Siak et al. disclose the problem or solutions to the problem of developing a high internal pressure in the sand mold mixture relative to its surroundings. More specifically, Matalon discloses using either a vacuum to pull air through the mold or a higher pressure air to blow air through the mold. In either case, the air pressure is higher on one side of the mold than on the other side of the mold, and there is a gradient or pressure drop across the mold. The pressure inside the mold is lower than the pressure on the outside of the mold at least on the side of the mold that is proximate the source of the air.

Claim 1

More particularly, claim 1 recites restraining a sand mold mixture and exposing the sand mold mixture to a vacuum. The vacuum is low enough to flash off the moisture in the sand mold mixture thereby drying the sand mold mixture to create a sand mold. The restrained sand mold mixture prevents voids in the sand mold.

The permeable sides of Matalon allow the movement of air through the mold box and, therefore, the permeable sides do not serve the same function of restraining the sand mold mixture to prevent cracks, voids, or other defects in the sand mold. Matalon neither teaches nor suggests using a vacuum to flash off the moisture in the sand mold mixture as recited in the claimed subject matter. Further, Matalon neither teaches nor suggests using the permeable sides to restrain the sand mold mixture during vacuum treatment of the sand mold mixture to prevent voids in the sand mold.

Although Siak et al. discloses the use of a vacuum to remove residual water from a sand core, nothing in Siak et al. either teaches or suggests restraining the sand during vacuum treatment. Further, Siak et al. does not disclose the problem of voids in the sand mold resulting from vacuum drying.

Because Matalon discloses the movement of air through a sand mold and Siak et al. discloses the use of a vacuum, there is no motivation to combine these references as they relate to different methods of drying a sand mold. One skilled in the art would not look to Matalon in determining how to use a vacuum to dry a sand mold, and one skilled in the art would not look to

Siak et al. in determining how to move air through a sand mold to dry the sand mold. There must be a basis in the art for combining the references, and because these references relate to different methods of drying a sand mold, there is no basis for combining these references.

Further, neither Matalon nor Siak et al. discloses the problem of voids in sand molds caused by vacuum drying. Therefore, restraining the sand mold mixtures to prevent voids in sand molds caused by vacuum drying is neither taught nor suggested by these references alone or in combination with one another. The claimed subject matter uses a vacuum to assist in rapidly drying restrained sand mold mixtures without producing cracks, voids, or other defects in the sand molds. This is neither taught nor suggested by these references.

Claim 8

More particularly, claim 8 recites placing a sand mold mixture containing moisture into a pattern, and placing a restraining member onto the pattern. The restraining member restrains the sand mold mixture within the pattern. The restrained sand mold mixture filled pattern is exposed to a vacuum low enough to flash off the moisture in the sand mold mixture thereby drying the sand mold mixture to create a sand mold. The restraining member prevents voids in the sand mold.

The permeable sides of Matalon allow the movement of air through the mold box and, therefore, the permeable sides do not serve the same function of restraining the sand mold mixture to prevent cracks, voids, or other defects in the sand mold. Matalon neither teaches nor suggests using a vacuum to flash off the moisture in the sand mold mixture as recited in the claimed subject matter. Further, Matalon neither teaches nor suggests using the permeable sides to restrain the sand mold mixture during vacuum treatment of the sand mold mixture to prevent voids in the sand mold.

Although Siak et al. discloses the use of a vacuum to remove residual water from a sand core, nothing in Siak et al. either teaches or suggests using a restraining member to restrain the sand during vacuum treatment. Further, Siak et al. does not disclose the problem of voids in the sand mold resulting from vacuum drying.

Because Matalon discloses the movement of air through a sand mold and Siak et al. discloses the use of a vacuum, there is no motivation to combine these references as they relate to different methods of drying a sand mold. One skilled in the art would not look to Matalon in determining how to use a vacuum to dry a sand mold, and one skilled in the art would not look to Siak et al. in determining how to move air through a sand mold to dry the sand mold. There must be a basis in the art for combining the references, and because these references relate to different methods of drying a sand mold, there is no basis for combining these references.

Further, neither Matalon nor Siak et al. discloses the problem of voids in sand molds caused by vacuum drying. Therefore, using a restraining member to prevent voids in sand molds

caused by vacuum drying is neither taught nor suggested by these references alone or in combination with one another. The claimed subject matter uses a vacuum and a restraining member to assist in rapidly drying sand mold mixtures without producing cracks, voids, or other defects in the sand molds. This is neither taught nor suggested by these references.

Claim 18

More particularly, claim 18 recites restraining a sand mold mixture containing moisture in a pattern by placing a perforated lid on the pattern. The perforated lid has apertures with a hydraulic radius of 0.5 inch or less. The pattern containing the sand mold mixture is exposed to a vacuum low enough to flash off the moisture in the sand mold mixture thereby drying the sand mold mixture to create a sand mold. The restraining member prevents voids in the sand mold.

The permeable sides of Matalon allow the movement of air through the mold box and, therefore, the permeable sides do not serve the same function of restraining the sand mold mixture to prevent cracks, voids, or other defects in the sand mold. Also, Matalon does not disclose a hydraulic radius of 0.5 inch or less in the permeable sides. Matalon neither teaches nor suggests using a vacuum to flash off the moisture in the sand mold mixture as recited in the claimed subject matter. Further, Matalon neither teaches nor suggests using the permeable sides to restrain the sand mold mixture during vacuum treatment of the sand mold mixture to prevent voids in the sand mold.

Although Siak et al. discloses the use of a vacuum to remove residual water from a sand core, nothing in Siak et al. either teaches or suggests using a restraining member to restrain the sand during vacuum treatment. Further, Siak et al. does not disclose the problem of voids in the sand mold resulting from vacuum drying.

Because Matalon discloses the movement of air through a sand mold and Siak et al. discloses the use of a vacuum, there is no motivation to combine these references as they relate to different methods of drying a sand mold. One skilled in the art would not look to Matalon in determining how to use a vacuum to dry a sand mold, and one skilled in the art would not look to Siak et al. in determining how to move air through a sand mold to dry the sand mold. There must be a basis in the art for combining the references, and because these references relate to different methods of drying a sand mold, there is no basis for combining these references.

Further, neither Matalon nor Siak et al. discloses the problem of voids in sand molds caused by vacuum drying. Therefore, using a restraining member to prevent voids in sand molds caused by vacuum drying is neither taught nor suggested by these references alone or in combination with one another. The claimed subject matter uses a vacuum and a restraining member to assist in rapidly drying sand mold mixtures without producing cracks, voids, or other defects in the sand molds. This is neither taught nor suggested by these references.

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CONCLUSION

Because neither Matalon nor Siak et al. teach or suggest using a restraining member to prevent voids in sand molds during vacuum drying, the claimed subject matter is not obvious in view of these references. In view of the aforesaid reasons, and those advanced during prosecution to date, the Appellant requests that the Examiner's rejections be reversed.

Respectfully submitted,

DANIEL L. FRANKLIN ET AL.

Date: 06/22/2005

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:ras

APPENDIX

LISTING OF CLAIMS

1. A method of making a sand mold, comprising:
 - a) placing a sand mold mixture containing moisture into a pattern;
 - b) restraining the sand mold mixture in the pattern; and
 - c) exposing the sand mold mixture to a vacuum, the vacuum being low enough to flash off the moisture in the sand mold mixture thereby drying the sand mold mixture to create a sand mold, the restrained sand mold mixture preventing voids in the sand mold.
2. The method of claim 1, the vacuum being less than 100 Torr.
3. The method of claim 2, the vacuum being preferably 4 to 5 Torr.
4. The method of claim 1, the sand mold mixture being exposed to the vacuum for less than 30 minutes.
5. The method of claim 1, further comprising heating the sand mold mixture before placing the sand mold mixture into the pattern.
6. The method of claim 5, the sand mold mixture being at least 140° F when placed into the vacuum chamber.
7. The method of claim 1, the sand mold mixture containing approximately 1.5 to 2.0% moisture by weight of the sand mold mixture when placed into the pattern.
8. A method of making a sand mold, comprising:
 - a) placing a sand mold mixture containing moisture into a pattern;

b) placing a restraining member onto the pattern, the restraining member restraining the sand mold mixture within the pattern; and

c) exposing the restrained sand mold mixture filled pattern to a vacuum, the vacuum being low enough to flash off the moisture in the sand mold mixture thereby drying the sand mold mixture to create a sand mold, the restraining member preventing voids in the sand mold.

9. The method of claim 8, further comprising heating binder coated sand and mixing the binder coated sand with water to create the sand mold mixture.

10. The method of claim 8, the binder coated sand being heated to approximately 180 to 200° F.

11. The method of claim 8, the sand mold mixture being at least 140° F when placed into the pattern.

12. The method of claim 8, further comprising heating water to approximately 150° F before mixing the water with the binder coated sand.

13. The method of claim 8, the vacuum being less than 100 Torr.

14. The method of claim 13, the vacuum being preferably 4 to 5 Torr.

15. The method of claim 8, the sand mold mixture being exposed to the vacuum for less than 30 minutes.

16. The method of claim 8, the restraining member including apertures having a hydraulic radius of 0.5 inch or less.

17. The method of claim 8, the sand mold mixture containing approximately 1.5 to 2.0% water by weight of the sand mold mixture when placed into the pattern.
18. A method of making a sand mold, comprising:
 - a) placing a sand mold mixture containing moisture into a pattern;
 - b) restraining the sand mold mixture in the pattern by placing a perforated lid on the pattern, the perforated lid having apertures with a hydraulic radius of 0.5 inch or less; and
 - c) exposing the pattern containing the sand mold mixture to a vacuum, the vacuum being low enough to flash off the moisture in the sand mold mixture thereby drying the sand mold mixture to create a sand mold, the restraining member preventing voids in the sand mold.
19. The method of claim 18, further comprising heating the sand mold mixture before placing the sand mold mixture into the pattern.
20. The method of claim 18, the vacuum being less than 100 Torr.
21. The method of claim 20, the sand mold mixture being exposed to the vacuum for 30 minutes or less.
22. The method of claim 18, the sand mold mixture containing approximately 1.5 to 2.0% moisture by weight of the sand mold mixture when placed into the pattern.